TEACHING EXTERNAL PHYSICS STUDENTS

THIRTY FIVE YEARS OF EVOLUTION IN EXTERNAL TEACHING

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External as an Afterthought

Thesis

• Physics has to have an experimental component therefore it can not be taught externally!
External as an Afterthought

Some students can not attend the campus during lab sessions (work, moved city)
• They could come onto campus for an intensive catch-up laboratory residency

So students can study externally and come on to campus once or twice a semester
• Yes but they miss out on lectures and tutorials and have to do all their study from the textbook!
• Some did this very well but many dropped out.
A Matter of Equity

No external mode of teaching excludes certain sections of the population from studying physics

- Country people who cannot get off the farm / leave family
- Mature aged / part time students who have to work to survive / support a family
- Care-ers who cannot leave their charges
- Armed forces personnel on secondment
- People in institutions (hospital, goal)
- Housebound people
- Poor people who cannot afford to move to the university
Define External

- Does not set foot on campus
- Cannot attend campus on a regular / scheduled basis
- Has clashes with other units and cannot attend labs / tutorials
External / Mixed Mode

• Now-a-days students see no distinction between internal and external studies.
• As far as they are concerned there are lots of ways of accessing the information and materials they need for their units and different students use what works best for them.
Who Is Using the External Mode?

• People who can not attend campus at the required time.
  – City / Country / Interstate / Off-shore / Overseas
  – Fly-in, fly-out
  – Armed forces
  – Remote locations farms / mining camps / oil rigs
  – Disabled
  – Reps
  – On remand
<table>
<thead>
<tr>
<th>Unit</th>
<th>Offering</th>
<th>Total # external students</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUA SCI16 General Physics</td>
<td>4 study periods</td>
<td></td>
</tr>
<tr>
<td>OUA SCI19 Principles of Physics</td>
<td>3 study periods</td>
<td>31</td>
</tr>
<tr>
<td>PEC120 General Physics</td>
<td>2 semesters</td>
<td></td>
</tr>
<tr>
<td>PEC152 Principles of Physics</td>
<td>2 semesters</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
External as a Forethought

• Thesis

Physics can be taught in the external mode. To do this, and have reasonable student retention rates, we have to provide external students with as rich an experience as possible.
35 Years Ago

Few students

- Text book
- Study guide and assignment information
- Experimental kit and lab manual
- Phone number of their supervisor or tutor

Assignments submitted in hardcopy through external studies.
Experimental Kits

- Add pictures
Tutor

• E-mail contact / human contact
• Initial welcome
• Deadline reminders
• Problem solving skill information
• Quick turn-around time
• Help and guidance physics
• Contact if things go quiet
• Information about support services
  – equity, counselling, deferred assessment, withdrawal dates
Now?

• Focus on flexibility, availability and student learning rather than staff teaching
• Provide resources and activities that facilitate student learning of content, skills, abilities and attitudes
• Same as before
  – Text book
  – Study guide and assignment information
  – Experimental kit and lab manual
  – E-mail of their supervisor or tutor
• On-line learning environment
On-line Learning

Welcome! This is where the PEC152 unit material will appear at the start of O-week. Meanwhile...

...all PEC152 students should do the Maths Diagnostic Quiz available from your MyUnits page. This will help us provide you with timely support for your maths skills, should you need it.

Find out how to refresh your maths skills.
On-line Learning - Refresh your maths skills

• Module 1 Numbers: Number lines and kinds of numbers; Basic powers and square roots; Inequalities and intervals; Fractions, decimals and percents
• Module 2 Computation: Calculations with percentages, fractions and decimals; Using powers and square roots; Rounding; Word problems
• Module 3 Measurement: Powers of ten; Units of measurement and conversions; Scientific notation; Significant figures
• Module 4 Ratios: Rates; Using ratios; Solving proportions; Word problems
• Module 5 Algebra: Symbols; Algebraic expressions; Algebraic fractions; Equations
• Module 6 Equations: Substituting in formulas; Rearranging formulas; Solving equations; Word problems
• Module 7 Graphs: Plotting points; Distance between points; Linear functions; Interpreting graphs
• Module 8 Trigonometry: Angles: degrees and radians; Sine, cosine and tangent; Pythagoras' Theorem; Solving problems
On-line Learning - Unit Information

GENERAL INFORMATION
Introduction to the Unit
Unit Coordinator and Contacts
Murdoch University: 2011 Academic Year

RESOURCES
Computer Information
Resources for the Unit

GETTING STARTED
General Advice on Studying the Unit
Study Schedule
Excel Exercises
External Students Experimental Kit
Equipment Kit Loan Form

TUTORIAL PRACTICE PROBLEM ANSWERS

ASSESSMENT INFORMATION
Assignment Details
Assignment 1
Assignment 2 - Scientific Report 7 Marking Key
Assignment 3
Assignment Submission Instructions
Assessment Policy
Assignment Hints
How to Write up a Lab Report
Examination Technique
Page of useful formulae
Page with dimensions of various units

PAST EXAMS
Answers to past exams 2003-2010
2009 S1 PEC152 exam
2009 S2 PEC152 exam
2010 S1 PEC152 exam
## On-line Learning – Study Schedule

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Module 1: Linear and Circular Motion</td>
</tr>
<tr>
<td>3-6</td>
<td>Module 2: Energy and Momentum</td>
</tr>
<tr>
<td>7</td>
<td>Module 3: Applications</td>
</tr>
<tr>
<td>8-12</td>
<td>Module 4: The Electric and Magnetic Field</td>
</tr>
<tr>
<td>13-14</td>
<td>Module 5A: Heat, Temperature, Energy Transfer and Entropy (Non Physics and Nanotechnology Students)</td>
</tr>
<tr>
<td></td>
<td>Module 5B: Oscillatory Motion and Waves (Physics &amp; Nanotechnology Students only)</td>
</tr>
</tbody>
</table>
On-line Learning – Study Schedule

• Module 1: Linear and Circular Motion
• Introduction
• Part A: Kinematics
  <snip>
• Part B: Dynamics
  <snip>
  • When you have completed this module you should be able to demonstrate your understanding of the topic by defining and explaining the following:
  <snip>
  • You should be able to analyse and calculate:
  ]<snip>
• Essential Reading
• Practice Problems
  <snip>
  • On the unit website as a collection of multiple choice questions. You can attempt these as often as you like until you get them right and no results are kept.
• In the textbook and they have a rectangle around the problem number. The answers to these problems can be found in the Students Solutions Manual
• Story-boarding
On-line Learning – Lab Manual

• David to give examples of video
On-line Learning

Initial Diagnostic Test
Lecture materials – PowerPoint and pre recorded audio
Self test - Multiple choice questions in multiple trial mode
Module Tests
Revision resources
• Tutorial practice problem answers
• Past exams
• Mindmap
Smart pen exams
On-line Learning - Community

• Discussion (David give examples)
• Students posting results and photos to share with external students (PEC231)
• FAQ (David give examples)
• Organising external geographical study groups
• Unrelated physics questions
## On-line Learning Links

### Angular Motion
- **Bicycle Wheel on a String**
  - [Video](http://www.youtube.com/watch?v=6H998gRzpDM&feature=related)
- **Bicycle Wheel and Rotating Platform**
  - [Video](http://www.youtube.com/watch?v=dYwK59yDqYo&feature=related)
- **Merry-go-round**
  - [Video](http://www.youtube.com/watch?v=us6CCWJpP3c)
- **On-line textbook**
  - This on-line textbook has some good information on angular momentum and torque.
  - [Link](http://www.lightandmatter.com/html_books/im/ch15/ch15.html)

### Friction
- **Wikipedia - Friction**
  - Good background info.
  - [Link](http://en.wikipedia.org/wiki/Friction)
- **The Physics Classroom - high school physics**
  - Some practice problems and answers.
  - [Link](http://www.physicsclassroom.com/class/newlaws/V2L3c.html)
- **How To Solve Physics Problems**
  - Gives a problem and how to solve it - Very similar to what Chris has already been telling you.
  - [Link](http://www.physics.hmc.edu/howto/problemsolving.html)

### Useful Physics Sites
- **Massachusetts Institute of Technology physics course material**
  - Includes videotapes of lectures. They do things a little differently and the way they do it may work for you.
  - [Link](http://ocw.mit.edu/OcwWeb/Physics/index.htm)
- **HyperPhysics**
  - HyperPhysics is an excellent website which explains the concepts and associated formulas we will be dealing with in a slightly different way to the textbook. In some places you can put your own values into the formulas and the results will be calculated for you.
  - [Link](http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html/hph)
- **University of Colorado**
  - The University of Colorado has constructed this website which has interactive simulations that could be useful to help you understand some of the basic concepts that we will be covering.
  - [Link](http://phet.colorado.edu/index.php)

### External web sites
- **Google Scholar**
  - Go to preferences in Google Scholar and select Murdoch University Library (SPX FindIT) as a Library Link.
  - [Link](http://www.scholar.google.com)

### Murdoch web sites
- **Murdoch University Library**
  - [Link](http://library.murdoch.edu.au/)
- **Subject Guides to Library Resources**
  - [Link](http://library.murdoch.edu.au/Getting-help/Subject-guides/)
- **ECMS**
  - [Link](http://prospero.murdoch.edu.au/search~S1/)
- **Academic Integrity**
  - [Link](http://our.murdoch.edu.au/Student-life/Study-successfully/Referencing-and-citing/How-to-avoid-plagiarism/)
On-line Assignment Submission

• Electronic submission
  – No lost assignments
  – Record of submission and return
    • Useful for students in transit (accommodation, jobs, cities, countries)
• E-mail, fax, post
• Assignment 2 (A Scientific Report on the physics of a Situation)
  – TurnItIn – reference checking software can be used many times
Novice / Expert

• Assignment 2 (A Scientific Report on the physics of a Situation)
  – TurnItIn – reference checking software can be used many times

• Opportunity to share some of their life with their tutors.
  – thermal expansion of naval cannons
  – kayaking around Hobart
  – change procedures for liquid flow rates through different sized tubes
Kit Update

Hardware

Software

• RealTime relativity software
  
  (L. McCalman, A. Searle, C. Savage and M. Williamson 2009)

• Vernier spectrum analysis software

Data

• Scans of various light source spectra (including LED’s)
Examinations

• Regional centers
• Person of responsibility
  – Submarine / ship captain
  – Local constabulary
  – Justice of peact
  – School teacher
Student feedback

• Like videos – face to voice
• “I just wanted to let someone know that for the entire time I was studying through Murdoch the support and help available to me as an external student was fantastic.”
• “I was the external student working away on the mine-site. After 6 yrs study I now have a degree in physics with a major in energy studies... I am now working for an energy efficiency company in Perth... I am now home every night”